TAXONOMIC NOTES ON THE *CENTROSEMA PUBESCENS* BENTHAM COMPLEX IN CENTRAL AMERICA (LEGUMINOSAE: PHASEOLEAE: CLITORIINAE)

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ABSTRACT

Two species in Central America are known by the name *Centrosema pubescens* Benth. Description and differentiation of the two taxa are presented, along with a record of the nomenclatural history of confusion with other species [*C. galeottii* Fantz, *C. macrocarpum* Benth., *C. molle* Mart. ex Benth., *C. schiedeanum* (Schlecht.) Williams & Clements, and *C. virginianum* (L.) Benth.], and commentary on the type specimen of *C. pubescens*. Evidence from the type indicates the name *C. pubescens* should be applied to an upland Central American species currently known as *C. galeottii* or *C. schiedeanum*. The widespread, lowland tropical species bearing the name *C. pubescens* must be renamed, with *C. molle* having priority.

RESUMEN

En Centroamérica son conocidas dos especies con el nombre de *Centrosema pubescens* Benth. Se presenta la descripción de los dos taxa, junto con la historia nomenclatural de confusión con otras especies [*C. galeottii* Fantz, *C. macrocarpum* Benth., *C. molle* Mart. ex Benth., *C. schiedeanum* (Schlecht.) Williams & Clements, y *C. virginianum* (L.) Benth.], y un comentario sobre el tipo de *C. pubescens*. Una vez examinado el tipo aparecen evidencias que indican que el nombre de *C. pubescens* debe ser aplicado a una especie de las tierras altas de Centroamérica conocida normalmente como *C. galeottii* o *C. schiedeanum*. La especie tropical de las tierras bajas conocida como *C. pubescens* debe ser renombrada, teniendo prioridad *C. molle*.

INTRODUCTION

Centrosema pubescens Bentham (Leguminosae, Phaseoleae, Clitoriinae) as treated by most authors is a neotropical species distributed from Mexico to Peru to Brazil. It has been introduced into the paleotropics as an ornamental vine or forage crop, and naturalized in Africa, Southeast Asia, Indonesia and Australia. It is an important, widely cultivated, species undergoing intensive research by agriculturalists (Schultz-Kraft & Clements 1990). Examination of Central American specimens has shown that the type specimen of *C. pubescens* belongs to another species often confused with it. The cultivated species should be renamed and a second species, unknown except to a few botanists, should bear the name of *Centrosema pubescens* Benth.

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CENTRAL AMERICAN "PUBESCENS" TAXA

Herbarium material named *C. pubescens* from Central America represents two distinct taxa. They will be referred to as Taxon A and Taxon B to simplify my discussion and to avoid confusion that would arise from using names. Table 1 compares distinguishing characters of these taxa.

Taxon A is widespread from Mexico to Peru and Brazil at 0–500 m, rarely to 800 m, and is the most commonly vouchered taxon of *Centrosema* in Central America. Collectors cite the habitat as grasslands, forest clearings or secondary vegetation, thickets, and pine-oak forests or subtropical montane forests. This is the agriculturally important species that has been introduced into Africa, southeast Asia, Indonesia and Australia. Leaves are short pilose-hispidulous above with uncinate trichomes on the midrib, densely short-pilose on major veins below, with age glabrescent. Flowers are white with a medial yellow stripe and purplish veins, pigmentation intensifying as the flower matures with lilac hues between the veins, thus "white or pale lilac" as noted by collectors. Bracteoles are uncinate-pubescent on the ventral third to half portion of the abaxial surface, glabrescent over the rest. The dorsal teeth of the calyx are fused to near the apex. The calyx is glabrescent with micro-uncinate trichomes prominent on teeth and more or less on the ventral surface. Fruits are 6–7 mm wide and immature ones are falcate to subfalcate in the upper half, but straighten with age. The pod valves become purplish-brown over the seeds, giving the appearance of transverse dark bands which fade with age, and are not conspicuous in all material of juvenile/immature fruits.

Taxon B is distributed from Mexico to western Panama at elevations of 500–2200 m. Collectors cite the habitat as ravines, limestone ridges, or black (volcanic) sandy soil associated with pine-oak-sweetgum forests or rain forests. This species has been relatively unknown to botanists until recent years. Leaves are short pilose-hispidulous above with uncinate trichomes on the midrib, densely pilose on the major veins below, glabrescent with age. Flowers are violet. Bracts are densely sericeous with trichomes long appressed, or ascending and spreading slightly at the apex. Pedicels are densely pubescent through the fruiting stage with ascending-appressed to spreading trichomes 1–2 mm long. Bracteoles are densely sericeous in bud; the abaxial surface is densely covered with long ascending trichomes that are deciduous as the flower matures to expose micro-uncinate trichomes only on the ventral half, although the dorsal half does thin with age. The calyx pubescence is prominently moderately sericeous with long ascending trichomes on the ventral (plus some dorsal) surface of the calyx tube that are deciduous with age, exposing dense micro-uncinate trichomes. Fruits are 6–8 mm wide and immature ones are falcate to subfalcate in the upper

TABLE 1. Comparison of two taxa known as *Centrosema pubescens*.

Character	Taxon A	Taxon B
Habitat elevation	0–500 (800) m	500–2200 m
Stipules	2–3 mm Deltate	3–5 mm Lance-deltate
Petiolules	2–3 (4) mm	(2) 3–5 mm
Bracts	4–6 × 1–2 mm Puberulous	6–9 × 3–6 mm Sericeous
Pedicels:		
In flower	6–9 mm Sparsely strigose	3–6 mm Sericeous
In fruit	9–12 mm Glabrescent	8–12 mm Thinly sericeous
Bracteoles	6–9 × 4–6 mm Uncinate-puberulous	10–16 × 6–9 mm Sericeous & uncinate-puberulous
Flowers	white, pale lilac	violaceous
Calyx teeth		
Dorsal & lateral	2–3 mm	3–5 mm
Ventral	5–7 mm	5–8 mm

half, but straighten with age. The pod valves become purplish-brown above the seeds, giving the appearance of dark spots to occasionally dark bands, but the bands are less prominent in this species and also fade with age.

Both taxa are confused with *C. macrocarpum* Benth. which can be distinguished by the broader calyx tube (7–9 mm diam.), elongated ventral lobe of the calyx (8–15 mm long), larger bracteoles (10–16 mm long × 5–9 mm wide) than Taxon B, but glabrate or sparsely uncinate-pubescent in the ventral half on the abaxial surface, fruiting pedicels that are thinly pubescent and broader fruits (8–10 mm wide).

Taxon A is confused frequently with *C. virginianum* (L.) Benth. which is recognized by its five elongated, subequal calyx lobes (5–9 mm) that exceed the tube (3–4 mm × 4–5 mm), by the violaceous flowers, and by the narrower fruit (4–5 mm wide).

MODERN TREATMENTS

Is *C. pubescens* Taxon A or Taxon B? Evidence from the literature indicates either taxon is *C. pubescens*, depending upon the author's interpretation. A chronological history of the nomenclature is presented for the reader's understanding of the problem.

Bentham (1837) originally described *C. pubescens* citing "Ad Tlalpuxahua Mexicanorum. Keerle in herb. Martius." The bracts were described as sericeo-

villous and bracteoles as sericeous on the outer surface. Bentham (1837) also originally described *C. molle* citing "In pascuis et pratis ad Para, et in sepibus ad Barra do Rio Negro. Martius." Bracteoles were described as puberulous. The calyces for both taxa was described as having four short teeth and a long vexillary tooth. Based upon the bracts and bracteoles, *C. pubescens* fits Taxon B and *C. molle* fits Taxon A.

Bentham in *Flora Brasiliensis* (1859) recognized one species in Brazil as *C. pubescens*, with *C. molle* cited in synonymy. The bracteoles were noted as puberulous. The description agrees with Taxon A, but it should be noted that Taxon B does not occur in Brazil.

Rose (1903) reported that at the type locality of *Bradburya schiedeana* (Schlecht.) Rose [basionym: *Clitoria schiedeana* Schlecht.] near Jalapa, Mexico. He found the plant in great abundance, cited his own collection as 6118 [*Rose & Hay 6118* (NY!)] and also the basionyn type, *Schiede 608* (HAL! - annotated as *C. pubescens* by me in early 70s). Both agree with Taxon B.

Identified material at the Field Museum of Natural History (F) follows the Costa Rican treatment of Standley (1937) and the Guatemalean treatment of Standley and Steyermark (1946). Specimens with the "bracts and bractlets [=bracteoles] densely sericeous with long appressed hairs" were identified as *C. pubescens*, following Bentham (1837), and agree with Taxon B. Specimens with "bracts and bractlets puberulent" were identified as *C. virginianum*. Specimens of this taxon at F from Costa Rica and Guatemala were identified as *C. virginianum*, supporting the treatments of Standley (1937) and Standley and Steyermark (1946). The published description of their species is a mixture of two taxa, the "puberulous" one [=Taxon A] and *C. virginianum*. Most authors recognize *C. virginianum* as a distinct species.

Barbosa-Fevereiro (1977) provided a taxonomic treatment of *Centrosema* for Brazil. This is the first revisionary treatment of the genus in over a century, thus one utilized as authorative by modern authors. Her annotations of Central American specimens supported her treatment of *C. pubescens* as a valid species. She annotated the type (at BR) in 1975. Placed in synonymy were *C. molle* Benth. and *C. schiedeanum* [as *Clitoria schiedeana* Schlecht.] Thus, the two taxa under discussion were treated by her as one species, following Bentham (1859).

Fantz (1979) provided a key to species of *Centrosema* reported to occur in Central America. Plants with the smaller bracteoles were identified as *C. pubescens*. Those with the larger sericeo-pilose bracteoles were identified as *Clitoria grandiflora* Mart. & Gal. The name *Centrosema grandiflorum* (Mart. & Gal.) Walp. is a later homonym of *Centrosema grandiflorum* Benth. (1837). Therefore, Fantz proposed the name *C. galeottii* lectotypified by *Galeotti 3284*. Many Central American specimens have been identified as *C. galeottii* (e.g. CR,ENCB,MEXU,MO), presumably following this publication.

R.J. Williams and R.J. Clements (CSIRO) in the latter 1970s began revisionary studies on the genus *Centrosema*. The type of *C. pubescens* (BR) was borrowed in 1978. R.J. Williams annotated *Hinton 7072* (K) with the following note, dated Jan '82: "*On Centrosema pubescens Benth.* Much of the material reference to this species by modern authors I find not to be conspecific with the type (Keerle, Tlapujahua Mexicana - BR ex herb Martii !). It remains for me to find a name for such material. Hinton 7072 is certainly "aff." *C. pubescens*." In the absence of flowers, bracteoles etc., one cannot place it with certainty. A lot of "*C. pubescens*" at K is *NOT* conspecific with the type, but this other material is not represented in my 1981 determinations." Sheets annotated by R.J. Williams as *C. pubescens* Benth. *sensu stricto* agree with Taxon B, whereas others representing the majority of specimens annotated as *C. pubescens* fit Taxon A. *Galeotti 3284* (K!) was annotated by R.J. Williams as *C. pubescens* and it agrees with Taxon B.

D'Arcy (1980) recognized only one species in Panama, *C. pubescens* with smaller bracteoles. He reported the type as "?M, not seen." D'Arcy reported two collections from Panama as conspicuously different in appearance, with much denser and longer pubescence on the bracteoles and bracts. He noted that an examination of other collections in Central America did not produce intermediates. He reported that Bentham's original description of the bracteoles and bracts matched these specimens, not the less pubescent plants that are widespread. D'Arcy was the first to report in literature that "recognition of more than one taxon might require renaming of the commoner plants rather than the unusual plants."

McVaugh (1987) recognized *C. pubescens* with the smaller bracteoles "uncinate-pubescent distally" as part of a widespread, lowland race (100–700 m) commonly encountered. He reported a higher elevation race (800–1400 m) with silky-pilose bracteoles, one rarely encountered (3 specimens cited) that was equivalent to Standley & Steyermark's *C. pubescens* (1946) and D'Arcy's reported unusual plants (1980).

A workshop on the biology, agronomy and utilization of *Centrosema* was held in 1987 at the Centro Internacional de Agricultura Tropical (CIAT), Cali, Colombia. Schultze-Kraft and Clements (1990) edited a volume with contributions from 52 authors that summarized the knowledge of *Centrosema* and its potential for providing additional species besides common centro (*C. pubescens* Benth.) for increased animal production and cover crops in plantation agriculture.

Williams and Clements (1990) presented the taxonomy of *Centrosema*, including a key and a table of recognized species, synonyms and sources of best descriptions. They recognized a species in Central America as *Centrosema schiedeanum* (ined.), noting by footnote the basionym as *Clitoria schiedeana* Schlechtendal, 1838. In effect, they validly published this new combina-

tion, and it should be cited as *Centrosema schiedeanum* (Schlecht.) Williams & Clements. This name was used for Taxon B. Williams and Clements (1990) recognized *C. pubescens* Benth. as a separate species, which is equivalent to Taxon A.

Schultze-Kraft et al. (1990) presented the biogeography of *Centrosema*, including maps of natural distribution for each species recognized. *Centrosema pubescens* (map 8) illustrates a wide-spread neotropical distribution whereas *C. schiedeanum* (map 5) is confined to an area from Mexico to central Panama with a few collections [introduced?] in Colombia.

Herbarium material of *Centrosema* from Central America has been examined by me in the 1990s for a treatment of the genus in *Flora Mesoamerica*. Identification of species of *Centrosema* are based historically upon characters of the bracteoles, the calyx teeth plus comparisons of the teeth length to the tube, floral color, and fruit size. Vegetative characters are less important, for a number of species exhibit infraspecific variation (e.g. leaflet size and shape) and similarity of characters with those of other species (e.g. growth form, stipules, vestiture). Most species in the *C. pubescens* complex are confused by modern botanists with one or more different species (i.e. *C. galeottii* Fantz, *C. macrocarpum* Benth., *C. schiedeanum*, *C. virginianum* (L.) Benth.) as evidenced by their misidentification of herbarium specimens. Several problems can occur in identification of herbarium material. Bracteoles commonly are larger than the calyx and obscure it, but are deciduous and are lacking in fruiting specimens. The calyx shrinks slightly as the fruit matures, and the longer ventral lobe often is broken. Mature fruits of herbarium specimens with evidence of dehiscence often have only remnants of calyces. Fruits of several species of *Centrosema are* similar or overlap in size. Fruiting specimens are most difficult to identify.

Examination of Central American material supported the conclusion presented by Williams and Clements (1990) at the conference. Material known traditionally from Central America as *Centrosema pubescens* includes two distinct taxa.

TYPE OF *CENTROSEMA PUBESCENS*

Bentham (1837) cited "Ad Tlalpuxahua Mexicanorum. Keerle in herb. Martius" for *C. pubescens*. D'Arcy (1980) suggested the type was at M, but Dr. H. Hertel (M, pers. comm.) reported that M does not have this specimen. Stafleu and Cowan (1981) reported that Martius' type specimens are at München (M), but types of species described by other authors are to be sought at Brussels (BR). The type of *C. pubescens* is deposited at BR, and annotated by Barbosa in 1975, but not by Williams.

The herbarium sheet (Fig. 1) at BR contains at least two and possibly three collections. Mounted on the left is *Wullschlägel 129* collected in 1858

from Gracehill Ant [Antigua, West Indies], and identified as *C. pubescens* Benth. - *molle* Mart. mss. Mounted on the right is a second specimen with a pencil notation at the top ("250") and a short line pointing to the specimen. This material agrees with the specimen mounted on the left. A third specimen in a plastic sleeve (Fig. 2) overlays this specimen (Fig. 1), attached by a paperclip, with a pencil notation ("72A") and an arrow drawn to it. Mounted on the right is an herbarium label as "Tlapujahua Mexicanor, T.W. Keerl, 1829."

The mounted specimens with both flowers and fruits belong to Taxon A. The dissected flower mounted on a small sheet and pasted in the upper left corner (presumably by Barbosa) belongs to Taxon A. The small specimen (Fig. 2) consisting of a flower lacking bracts & bracteoles, one fragramented leaf, and a few additional peduncles belongs to Taxon B and matches most closely Bentham's (1837) protologue.

The U.S. Office of Geography (1956) indicated the correct name to be Tlalpujahua de Rayón (19°48'N, 100°10'W), not spelled with the "x" as cited by Bentham (1837). This populated site commonly is lacking in atlases. The Operational Navigation Chart (1985) mapped Tlalpujahua in the upland mountains just west from El Oro (Ixtapan del Oro), and across the border into the state of Michoacán.

DISCUSSION

Barbosa-Fevereiro (1977) cited "Holótipo: Ad Tlalpuxahua Mexicanorum. Keerle." as the type for *C. pubescens* Benth. Questions arise regarding the Keerle specimen. Are there one or two Keerle specimens? Who annotated the samples on the right with numbers and drew lines to the material? When those numbers were added and upon what basis is unknown.

The specimen mounted on the right does not match the original diagnosis (sericeous bracts & bracteoles) nor is this specimen in agreement with those collected in upland mountain habitats (Taxon B). This specimen agrees with Taxon A, a lowland species. The specimen on the right may represent more material of *Wullschlägel 129*, or a second collection (no. 250?) by Wullschlägel from Antigua, but it is not type material.

The specimen (Fig. 2) in the plastic sleeve matches closely with Bentham's (1837) protologue, and is in agreement with the upland species (Taxon B) that matches the type locality. This specimen is *C. pubescens* Benth., *sensu stricto*, from Herb. Martii as cited by Bentham (1837), therefore, it is recognized as the holotype. The number "72A" will be disregarded in citations as it is unknown if it indeed applies to the Keerle specimen.

Bentham (1859) recognized both Taxon A and Taxon B as a single species *C. pubescens*. Do these taxa belong to the same species? These taxa are treated as *C. pubescens, sensu lato*, by Barbosa-Fevereiro (1977), D'Arcy (1980)

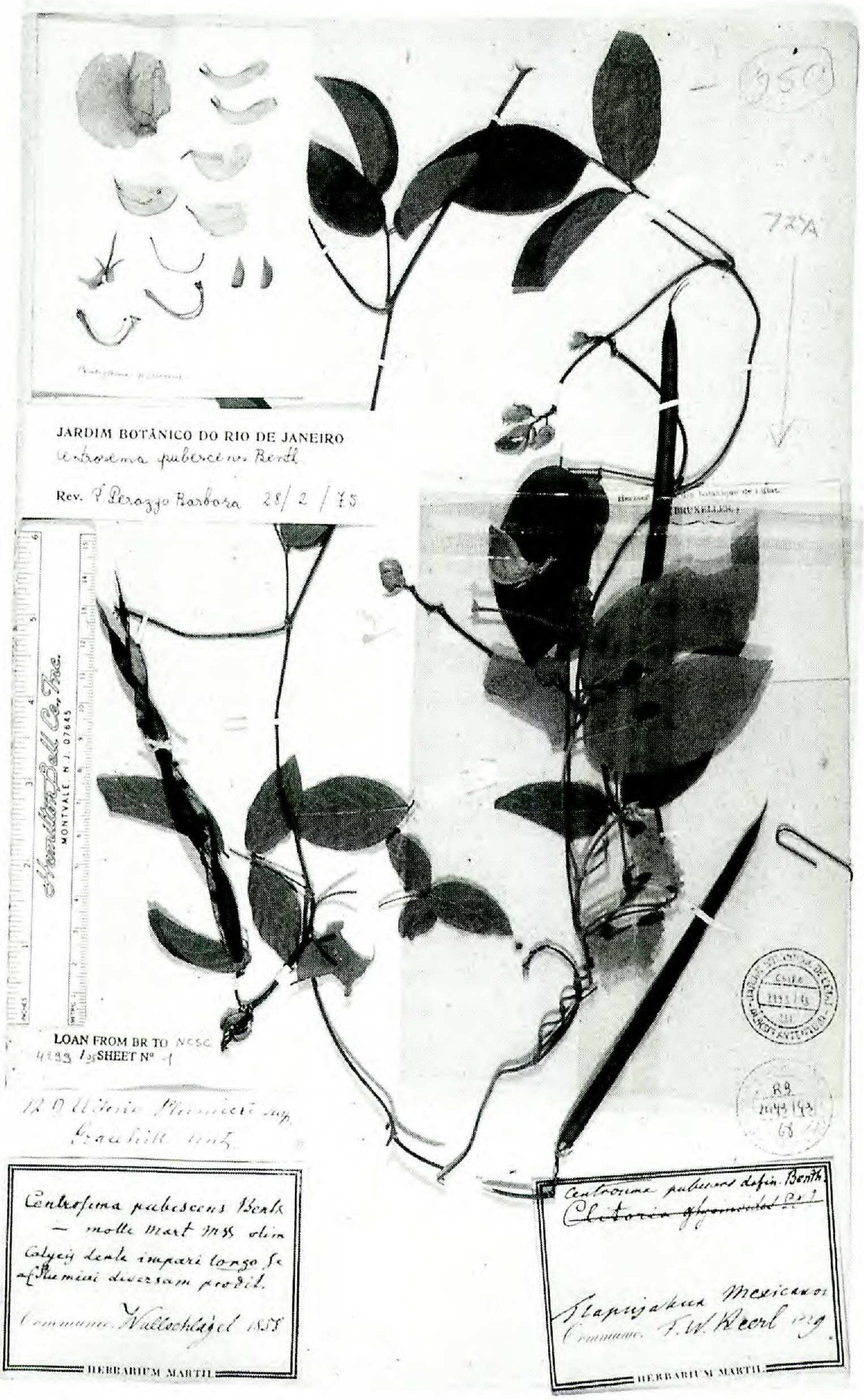

FIG. 1. Photograph of herbarium sheet (BR) that contains the cited type (*Keerle*: Ad Tlapajuhua, Mexico) for *Centrosema pubescens* Bentham.

FIG. 2. The BR specimen, removed from plastic sleeve in Fig. 1, that agrees with Bentham's protologue of *Centrosema pubescens*.

and McVaugh (1987), although the latter two recognized a few specimens as distinct. Should they be treated as infraspecific taxa of one species? Standley (1937), Standley and Steyermark (1946), Fantz (1979), and Williams and Clements (1990) segregated these taxa as distinct species in Central America, but utilized different names (or recognized such in notes). A number of modern botanists working in Central America are distinguishing these taxa as two distinct species as evidenced by annotation labels on herbarium sheets examined for the *Flora Mesoamerica* project.

CONCLUSION

Evidence indicates that two distinct species are recognized as *C. pubescens*. Which taxon should bear the name *C. pubescens?* Evidence from the holotype indicates that it is Taxon B. In addition, the names *C. galeottii* and *C. schiedeanum* agree with Taxon B, and should be placed in synonymy. Therefore, the following nomenclature is produced for Taxon B:

Centrosema pubescens Benth., Comm. Leg. Gen. 55. 1837; Ann. Wiener Mus. Naturgesch. 2:119. 1839. *Bradburya pubescens* (Benth.) O. Ktze, Revis. Gen. Pl. 1:164. 1891. TYPE: MEXICO. MICHOACÁN: Ad Tlalpuxahua Mexicanorum. *Keerle s.n.* (HOLOTYPE: BR–ex hb. Martius, mounted in a plastic sleeve and paperclipped to the herbarium sheet above another specimen – cf. Fig. 1).

Clitoria schiedeana Schlecht., Linnaea 12(3):284. 1838. *Bradburya schiedeana* (Schlecht.) Rose, Contr. U.S. Natl. Herb. 8:46. 1899. *Centrosema schiedeanum* (Schlecht.) Williams & Clements. In: Schultze-Kraft and Clements, eds. *Centrosema*: Biology, Agronomy, and Utilization, p. 7, tab. 1 (as *ined.*). 1990. TYPE: MEXICO. VERA CRUZ: In dumetis pr. Jalapam Aug, Hacienda de La Laguna, Sep, *Schiede 608* (LECTOTYPE, here designated: HAL 36864; ISOLECTOTYPES: B-destroyed, HAL 34078- sh. 1!, HAL 34078-sh. 2!, HAL 37536!

Clitoria grandiflora Mart. & Gal., Bull. Acad. Brux. 10:189. 1843. *Centrosema grandiflorum* Walp., Repert. bot. syst. 5:529. 1846. (*non* Benth. 1837). *Centrosema galeottii* Fantz, Sida 8:155. 1979. TYPE: MEXICO. VERA CRUZ: fl. lilac, bois, Cordillère, 3000 pied., Jun–Oct 1840, *H. Galeotti 3284* (LECTOTYPE: BR!-designated by Fantz, Sida 8:155. 1979; ISOLECTOTYPES: K!- hb. Hook., TEX!-photo of G).

Taxon A now must be renamed. A name is available from synonymy that now has priority. Nomenclature for Taxon A is as follows:

Centrosema molle Mart. ex Benth., Comm. Leg. Gen. 55. 1837; Ann. Weiner Mus. Naturgesch. 2:119. 1839. SYNTYPES: BRAZIL. RIO NEGRO: Clitoria flore amplo, albo, vexillo in medio s*** [?] violaceas, in sylvis ad Barra do Rio Negro, *Martius s.n.* (M 12505!). BRAZIL. Para: in pascuis et pratis, ad Para, *Martius* (M).

Centrosema pubescens Auth.; Benth. In: Martius, Fl. Bras. 15:131. 1859; Barbosa-Fevereiro. Rodriguésia 42:184. 1977; *non* Benth. (1837).

Centrosema virginianum L. *pro parte*, Standley. Flora Costa Rica. Publ. Field Mus. Nat. Hist., Bot. Ser. 18:528. 1937; Standley & Steyermark. Flora of Guatemala, Fieldiana, Bot. 25:181. 1946; *non* L.

ADDITIONAL TYPE NOTES

Schlechtendal (1838) cited one collection of Schiede in his protologue for *Clitoria schiedeana*, but did not cite an institution of deposit. Types of both Schlechtendal and Schiede material are deposited at B and HAL, with potential duplicates at several other institutions (Stafleu & Cowen 1985). Berlin material was destroyed in World War II. Four sheets were found at HAL with these duplicates incorporated into the collection on three different dates. These are treated as syntypes, as discussed by Fantz (1993). The lectotype designated herein bears the name *Clitoria schiedeana sp. nov.* and agrees best with the protologue.

Martius type specimens are at M with types of species of other authors often at BR (Stafleu and Cowan 1981). Curator Paul Bamps (BR, pers. comm.) reported that types for *C. molle* were at at M, not in their collection. Only one sheet, the Rio Negro syntype (M) was included in a loan request of types. R.J. Clements (pers. comm.) reported four Martius sheets at M, and recognizes the Para collection (M) to be the lectotype.

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